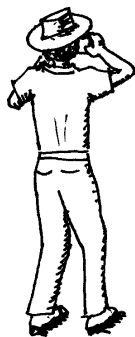
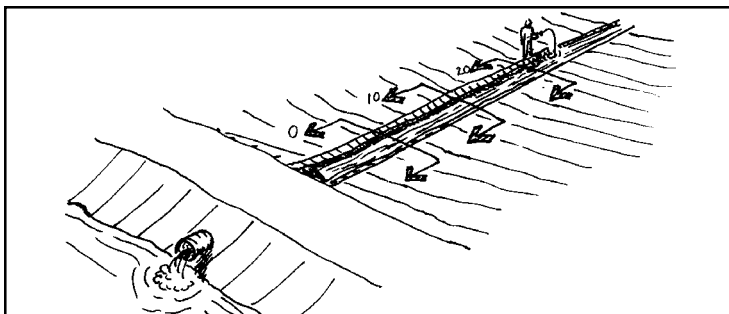
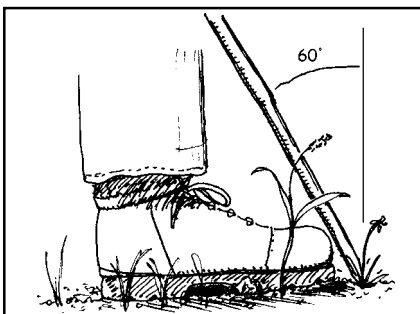
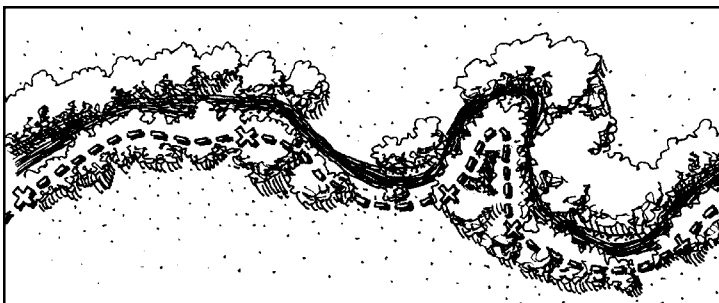


Monitoring on Your Farm



A Guide to Tracking and
Understanding the Resources
and Wildlife on Your Land

Utilizing Low-Cost, Low-Tech Equipment
and Easy Methods with Minimal Time Input



Yolo County Resource Conservation District

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For additional copies of this publication, please call 530.662.2037, ext. 5 or send a check for \$15 (per copy) plus shipping and handling, payable to “Yolo County RCD” and a note requesting *Monitoring on Your Farm* to:

Yolo County RCD - Publications
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Bring Farm Edges Back to Life! - \$15

Know Your Natives (Guide to Native Plants) - \$25

Hedgerow Installation video - \$10

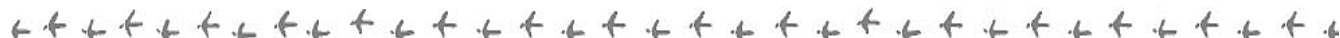
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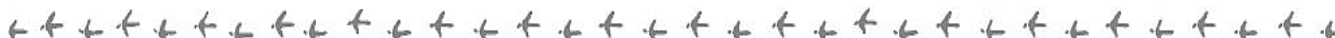
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PREFACE

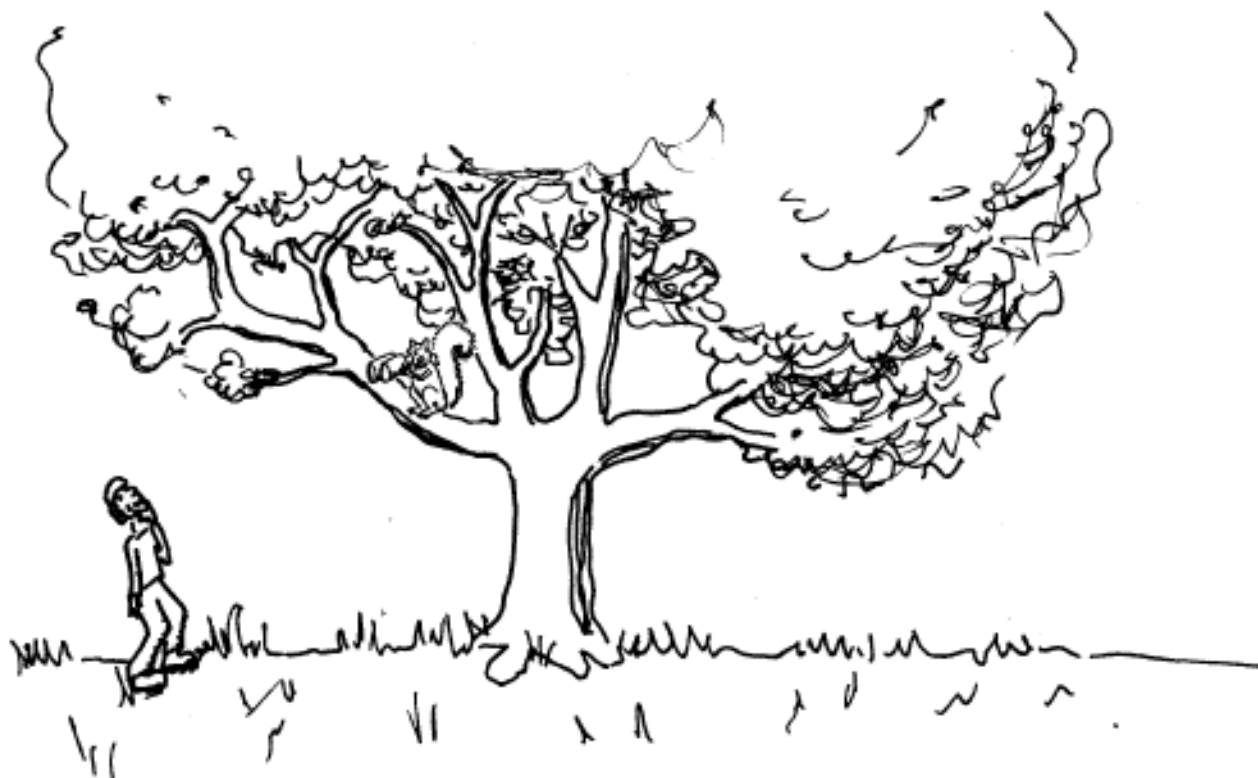
I began this effort in order to share some of what I have learned and developed at the Yolo County Resource Conservation District (RCD) in recent years about the loosely-defined subject of “monitoring.” My desire is to pass along the practical aspects of the process, along with a little bit of philosophy – but mostly the practical stuff, since that’s where the rubber meets the road. Lots of commentary and theory can be debated, but when it actually comes down to getting the job done . . . we are all looking for *what is it that gets the job done!*

One goal of this guide is to provide you with suggestions and ideas for monitoring equipment that are low cost, low-tech, and easy to come by. Another goal is to suggest methods that are fairly simple and that require a minimum of time input for the information gathered. The equipment and methods presented here do require some money, but mainly time and commitment. Since a third goal of this guide is to be as succinct as possible, certain peripheral details are left out. You

may not be reminded to do such things as store your negatives carefully if you are photo-monitoring, or to bring along your notebook or binoculars!

Technical, complex and expensive methods of monitoring abound and many of them do a wonderful job of providing the answers you may want. I have enjoyed using many of these methods myself. However, from my perspective, there is beauty in simplicity. That quality, applied to both the tools and the methods, provides a much greater likelihood that the monitoring will actually get done.

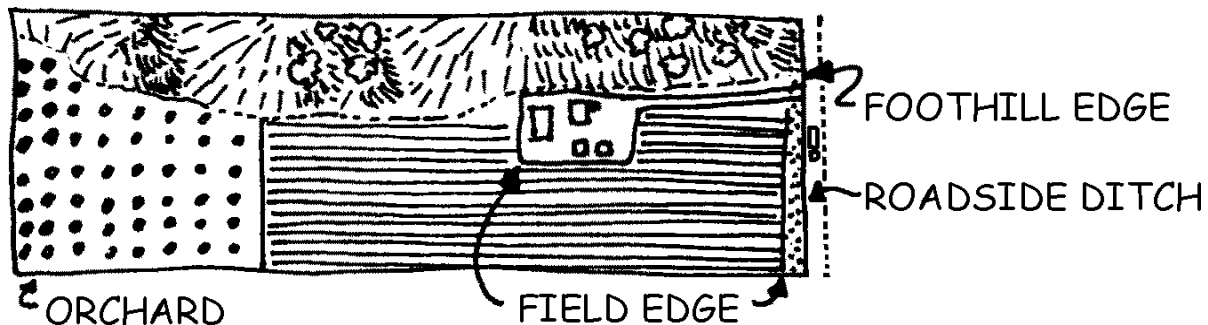
Monitoring on our own property and within our home watershed are likely to become increasingly important. In the process of learning more about our own farms through monitoring, we, as individuals and as a group can show others (be they our neighbors or our legislators) what we have been doing to be good stewards of the land. “Good stewardship” benefits both our farming operations, and our neighbors near and far.



I have come across a number of other written guides to monitoring. Some are highly technical manuals from agencies or special interest organizations. I will refer to some of these guides, since they have been valuable resources to me both in deciding what *to* do and what *not* to do for particular projects. This guide is intended to provide simple methods – based on more complex approaches – for tracking change while providing a basis for adapting management decisions over time. While developed for Yolo County, California in particular, much is transferable to practically any location, with just minor adjustments.

Much of what is in this manual can be closely tied with another RCD publication entitled *Bring Farm Edges Back to Life*. That publication discusses numerous conservation methods and techniques that can be integrated into a normal farming operation or implemented on any private land, to help address resource conservation problems such as weeds, silt deposits, beneficial insect habitat and soil stability. At the same time these practices can provide many additional benefits.

If conservation practices are about to be implemented, there is an excellent opportunity to start a monitoring program, beginning before the changes are made. There is a section at the end of this manual describing the same example farms used in *Bring Farm Edges Back to Life*. These farms will have brief descriptions of some of their pertinent land characteristics. Along with these are descriptions of possible conservation practices. Refer to that publication if you want to learn how to design and install these conservation practices. They may be similar to some of the changes you have considered. If so, there are potential monitoring activities described here that could go along with them.





HOW TO USE THIS GUIDE

This guide is divided into sections to allow you to locate a subject quickly.

The **introductory section** talks about:

- ☞ The concept of monitoring
- ☞ The thinking process
- ☞ Questions to ask regarding living and lifestyle
- ☞ Questions to start you thinking about your land and your goals for it
- ☞ Questions about the living things that occupy the place
- ☞ Deciding what, when and how to monitor

Don't skip those, unless you already feel pretty comfortable with monitoring.

Next will be separate **sections on specific topics** or areas to monitor:

- ☞ Photo-Monitoring
- ☞ Soil
- ☞ Water
- ☞ Plants
- ☞ Animals
- ☞ Birds
- ☞ Mammals
- ☞ Reptiles and amphibians
- ☞ Insects

Each section will contain:

- ☞ a short discussion
- ☞ equipment needed
- ☞ costs, if appropriate
- ☞ explanation of procedures

- ☞ estimated time to complete the task
- ☞ a summary card (somewhat like a recipe), containing:
 - equipment list
 - procedure summary
- ☞ a data sheet or other form for recording the information that you collect
- ☞ sources, references, guides, handbooks and/or websites

For two reasons it would be best to photocopy the data sheet and bring the copy out into the field with you. First, it will invariably get muddy or ripped or dropped in the water. Second, if you write on the original, you won't have another to use for the next project.

The **resource lists** won't be exhaustive, but should be helpful. The extent to which you explore these is up to you and will, I'm sure, depend on the amount of time and interest you have.

Please keep in mind that this is not a *technical* guide. You will not find endless equations or articles from engineering journals. Expect practical information that you can put into use as soon as you read it.





I. INTRODUCTION TO MONITORING ON YOUR FARM

What is "your farm?"

A discussion about monitoring on your farm should start with what is meant by "your farm." That term could mean an actual farm (a place where some food, fiber or domestic animal product is produced and where a profitable income is expected from those products). But, your farm could also include *any* piece of land – however small or large – that you call your own. Many of the techniques presented in this manual would work well in your own backyard. For the purposes of this manual, monitoring involves gathering basic information about your land and its users (not all of them human) that is useful to you as the landowner.

It is important to recognize that your farm doesn't exist in its own world. It is affected by the other farms around it and by the larger landscape, of which it is only a small part. In the same way, either the farm, or you and your family, are equally connected to and dependent upon a community of people for other needed resources, for support, and for enrichment. Because of these connections, sharing your results may be useful to many other people who are a part of your community, or a larger watershed.

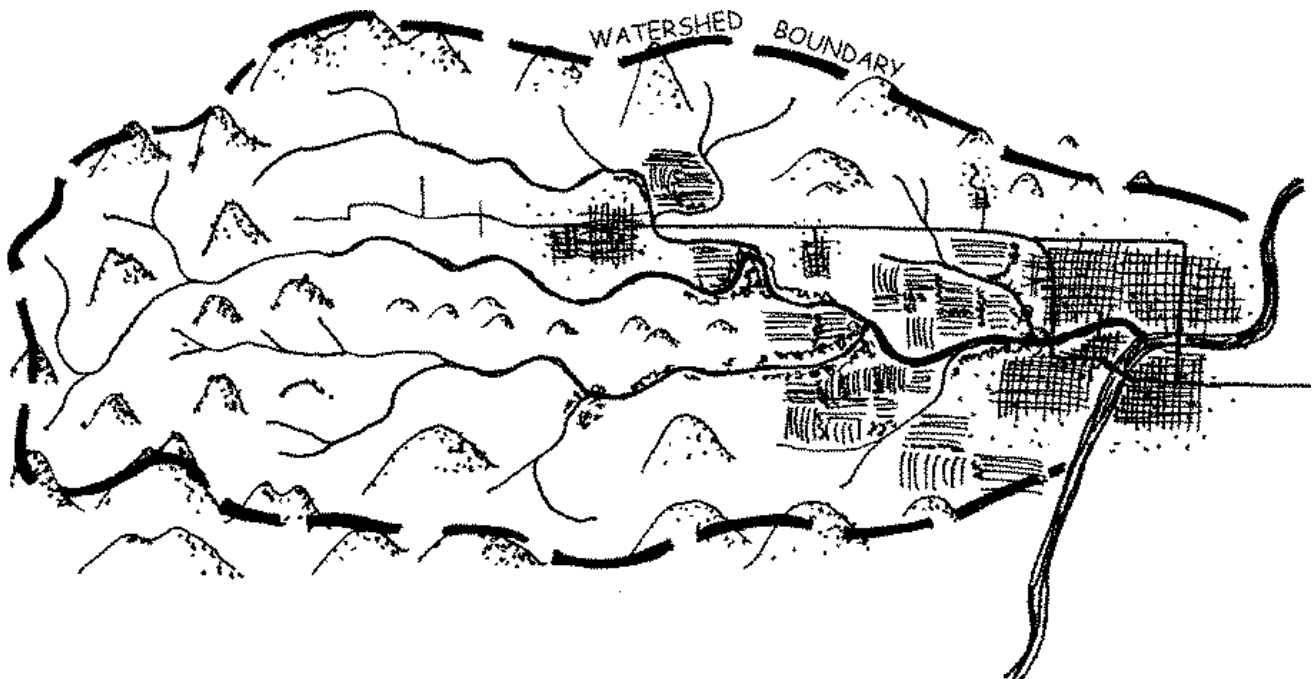
What is monitoring?

Monitoring usually goes hand-in-hand with some form of management change hoped-for. However, monitoring can be very valuable for simple fluctuations in natural conditions.

There may be some differences - either short-term or long-term - in the way the land looks, feels or functions as a result of new ownership, changing uses, or natural conditions. If you would like to *know* if real changes are happening, monitoring can help. Monitoring can also help to check your progress toward your goals and re-focus your efforts.

The changes you are looking for may be as short-term as before to after, season to season, or as long-term as decade to decade. They may be related to anything from plant species differences to economics to how a

Monitoring is a set of activities aimed at measuring change in some informal, yet consistent way.



place “feels” to walk through. They may involve only once-a-year efforts, or very intensive time for short periods. You will be the one deciding, based upon what you want to find out. The amount of input is up to you. *The key to having it work is to be committed and consistent!*

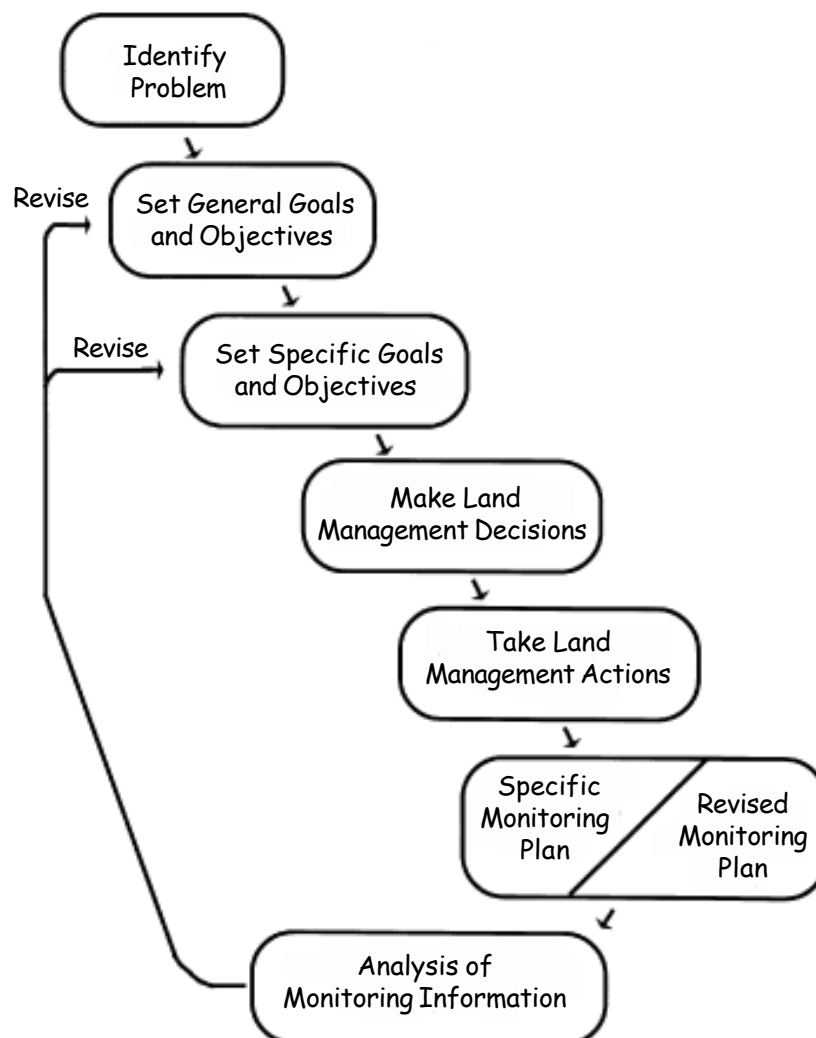
Monitoring vs. research

Research is a very intensive way of studying something. It requires very careful planning – sometimes a year or more ahead of time. It also requires carefully phrased questions, placing intentional limits on the answers that can be achieved, and a lot of time in between spent gathering specific information. To

be legitimate there must even be several duplicates (replications) at the same location of all variables that are in the test. Anyone can do research, given the know-how, but it’s tricky. It helps to have some experience or to work with someone else who does.

Monitoring, on the other hand, is a lot more low-key, but just as legitimate for its intended purpose. It may not provide irrefutable answers with statistical confidence levels attached to them, but if done correctly, can accurately document changes in natural resource conditions, show trends in land use, measure differences between land areas, or measure qualitative changes that don’t involve hard numbers.

Adaptive Management Flow Chart



Why monitor?

Your monitoring program may allow you to:

1. Establish some “baselines.” These are basically definitions of your existing situation.
2. Follow general trends or normal fluctuations in natural resource conditions
3. Track specific species – how they increase, decrease, stay the same
4. Follow changing use of resources by wildlife
5. Improve the management on your land (determine its effectiveness and modify it accordingly)
6. Help you decide if you are meeting your goals or going in the right direction
7. Measure economic success
8. Involve other members of your family in the farm
9. Help you avoid regulation
10. Help you get to know your farm or ranch better
11. Address personal or community issues

The information you get through monitoring fits into a feedback loop (see “Adaptive Management Flow Chart,” above), allowing you to change your management decisions to fit reality. Although you may be convinced from the start that the changes you intend to make will be an improvement, that may or may not actually be true. You may *think* you are seeing a change happening, but are you really *sure*? Monitoring can help you find out if your new way of treating the land is actually a benefit or a detriment. You may be surprised. Try to maintain a “neutral” frame of mind.



From a landscape viewpoint, your small pieces of localized information may make important contributions to a broader understanding of the area you live in, and may give you a sense of how each small area contributes to the intricate functioning of the larger whole. This understanding leads to more effective solutions if problems exist or arise, and shows you how to work *with* the land and not *against* it. There may be local or regional land-use or resource issues that are important to you as well as your neighbors. Monitoring information, especially if gathered by several landowners, can be a powerful tool for addressing these issues, so try getting your neighbors involved. They may be able to share the work.

Time expenditures

Be realistic. Spend as little time doing monitoring as you can to still get the information you will need to make decisions. If you don't have the time, get someone else to help, such as a hired hand or your kids. Monitoring can be a good school science fair, 4-H, or FFA project.

Some monitoring work requires more time than others. Time estimates are given under the topic sections, but first attempts at a given activity may take a little longer.

What to monitor

There are innumerable things that you could choose to monitor. Ask yourself any of the following questions.

Q: What interests me most about my land?

Possible answers

“Just being a landowner!”
“How can I *keep* it?”



Q: What are my 3 biggest concerns about my ranch?

Possible answers:

“The soil seems to be compacting.”
“I have a lot of weeds.”
“I need to use my water more efficiently.”



Q: What would I like to see be different about my farm?

Possible answers:

“I'd like to have about a 5 acre corner of it be a safe place for my kids to play and to explore the outdoors on their own.”



Q: Am I happy about how farming affects my life?

Possible answer:

“I like the rural lifestyle, but I feel isolated.”

Answers to these questions give you your first clues to what you should monitor.

If you have a serious weed problem in a particular area, you could seek some advice on setting up a 2 to 3 year plan for management or control. Monitor changing plant populations two times each year for at least those three years to see if you are achieving your goal.



When thinking about what to monitor, consider things such as:

1. long-term goals
2. short-term goals
3. time investment
4. how you prefer to spend your time
5. financial return
6. personal satisfaction
7. time spent with family
8. time spent in community
9. quality of life
10. feelings, such as satisfaction, thankfulness, concern, frustration, and hope



Examples of what to monitor

ENERGY USE (not specifically covered in this manual, but can be easily tracked with your existing business records)

Things to monitor in the area of energy use could include:

- ☞ personal time and energy
- ☞ time spent by book-keepers or other employees
- ☞ amount of electricity, diesel fuel and gasoline used to keep things operating

ECONOMICS (work with your accountant)

Economics and profitability are often critical to your ability to continue to *enjoy* the place where you live or farm. Try taking a new look at:

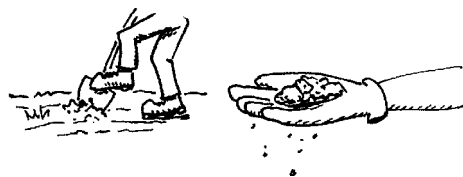
- ☞ month-to-month cash flows
- ☞ annual balance sheets
- ☞ long-term goals



If your answer to the first question was "How can I keep it" then you may want to do some financial monitoring with the assistance of an accountant. You could also set a goal to increase the value of your ranch in the eyes of the larger community. You could monitor your progress toward that goal by measuring the number of people, outside of family members, that have attended one of your "cattle drive" experiences, or who have participated in a bird count along your creek. These people are more likely to want to see your property remain as one large ranch rather than being split up for housing, and could provide support in the future.

NATURAL RESOURCES

Natural resources are often the unspoken treasures of a landowner. They have a value that goes beyond what is measurable in numbers. However, there are many things that we *can* measure that can give an understanding of the condition they are in. Places to examine include intensively-farmed areas, field edges, roads, woodlands, and streams. Consider looking more closely at:



SOIL

- ☞ The ability of soil to hold water
- ☞ Basic fertility of the soil
- ☞ Soil "tilth"
- ☞ Soil quality (overall "health," salinity, sand/silt/clay content)
- ☞ Soil stability against erosion during storms

- ☞ Soil stability along waterways such as creeks, sloughs or ditches
- ☞ The ability of the soil to support life (above ground, below ground)



GEOGRAPHIC CHARACTERISTICS

- ☞ Land slopes
- ☞ Rockiness, soil cover, soil type
- ☞ Sun exposure
- ☞ Nearby waterways
- ☞ Neighbors

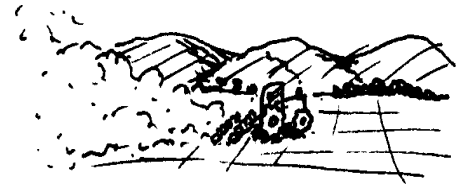
WATER

- ☞ Water quality (taste, purity, sediments, fertility)
- ☞ Water quantity
- ☞ Water flow characteristics (field, farm, local, regional)
- ☞ Water temperature, Dissolved oxygen, pH



PLANTS

- ☞ Plant communities (landscape level examinations, broad transects)
- ☞ Surveys for classes of plants (grasses, forbs, shrubs, trees)
- ☞ Surveys for species (specific weeds, endangered species)
- ☞ Density of plant cover
- ☞ Crop characteristics
- ☞ Special status (threatened or endangered) species



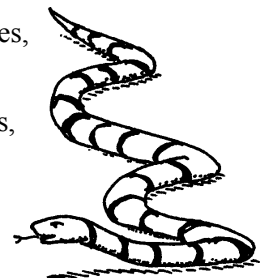
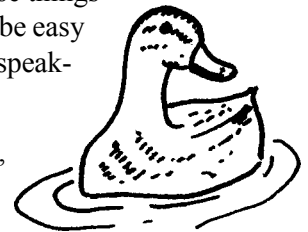
AIR

- ☞ Haziness
- ☞ Smoke
- ☞ Dust
- ☞ Pesticides moving with air currents
- ☞ Temperature
- ☞ Precipitation
- ☞ Weather patterns

WILDLIFE

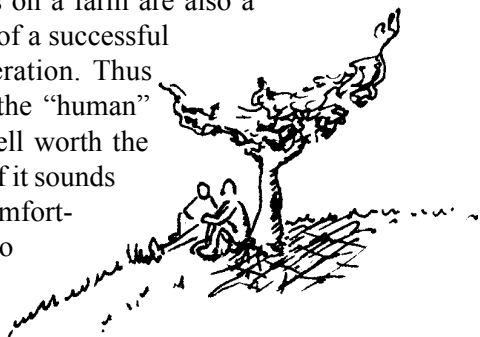
The term "wildlife" includes a whole host of living things. Truly, it includes everything from bacteria to elephants, but not all of those things may be of interest to you or be easy to keep track of. Practically speaking, the list might include:

- ☞ Insects (crop pests, beneficial insects, pollinators, neutrals)
- ☞ Birds (raptors, song birds (residents vs. migrants), shorebirds, game-birds: waterfowl, turkey, quail)
- ☞ Mammals (small rodents, predatory cats, game species, livestock)
- ☞ Reptiles (lizards, snakes, turtles)
- ☞ Amphibians (frogs, toads, salamanders)
- ☞ Fish



Quality of Life and Farm Family Factors

The quality of the life you live as it relates to your land can be examined by looking at things such as your goals, expectations, satisfaction, or dreams, and how close you come to fulfilling them or how quickly you are moving toward them. The interactions of the family members on a farm are also a critical part of a successful farming operation. Thus monitoring the “human” factors is well worth the time spent. If it sounds like an uncomfortable thing to do, keep in mind that *you* are



the one determining what and how something will be monitored. Your methods can be modified according to your comfort level.

If you have goals for your farm, it is certain that they are tied up with issues of your own happiness, peace of mind, sense of accomplishment, or connection to the land or your community. Just as you may want to know if your soil health is improving, you may want to find a way to measure whether or not you are moving closer to your personal goals as a farmer or landowner.

Do some thinking about whether you would like to re-examine your overall progress once a year, every six months, or if you would like to “check in” on shorter-term issues monthly or weekly.

You should include your entire family in some way. Even small voices can make remarkably good sense. Including them can awaken their interest in the land and they may be interested in helping with the monitoring. Be willing to ask some basic but very important questions and listen closely to your own – and everyone else’s – honest answers.

At the end of this introductory section is a worksheet with questions to ask yourself and your family members. These will help you begin to clarify how your life and your family are tied to your land, and how to get more of what you want from the life you have chosen with the land. Rephrase them as you need in order to fit your situation.

Example Farms

In trying to decide what monitoring really means for you and how you can integrate it into the many other daily activities on a farm, it can often be helpful to hear about a farm or piece of land that may be similar to your own in some way. There are three example farms described in the last section of this manual before the Resources Section. These are taken from another RCD publication: *Bring Farm Edges Back to Life!* The farms are described just as they are in that publication, along with some proposed conservation practices.

The changes in farm management that go along with the implementation of conservation practices can be a good opportunity to try some monitoring techniques. Some possible monitoring practices will be listed for each of the example farms.

In the *Farm Edges* publication, conservation methods are discussed that can enhance and improve the natural resource conditions on your land, while decreasing problems such as weeds, siltation, water use efficiency, habitat for beneficial insects and habitat for other wildlife. The methods and techniques discussed in that publication can go hand-in-hand with much of the monitoring methods described in this manual.

Where To Monitor

This is an area where monitoring diverges *greatly* from research. In doing research, data is usually gathered “randomly” or else in a strictly systematic way so as to eliminate personal bias. For monitoring choose a *likely* place to see those things you are interested in tracking! Then stick with it!

If you want to discover if your management practices (i.e. grazing time and duration) are allowing clover to spread without additional seeding:

- ☞ Locate your monitoring exactly at some key clover patches and in the fields the cattle typically move to next!

If you want to know if a check dam in the streambed will reduce stream bank erosion either above or below the site:

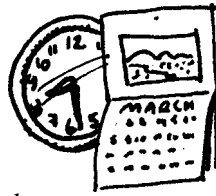
- ☞ Locate your monitoring site exactly at the future check dam location, with stations above and below.

If you want to know if or where any songbirds frequent your place:

- ❧ Find a place where birds might find food and shelter and plan to go out *early* in the morning to find them.

When To Monitor

What is it that determines frequency of monitoring?



The time of day, day of the week or month of the year that you should be out doing monitoring activities is all your decision (and partly determined by Mother Nature), although some of the decisions you make may lock you into certain schedules.

The amount of time you have available is probably the most important factor, along with how important certain information is to you. If you are able to enlist the support of students or volunteers, your time may be more freed up.

The condition of the resources that you plan to monitor can sometimes dictate the timing of your monitoring activities.

For “before/after” kinds of monitoring, the timing is determined by the start and end of your project. If you are digging a pond, photos and plant surveys should be done before the pond is dug and during a season of late plant growth and early maturation.

For determining seasonal changes in conditions, plan to go out and complete your activities four times each year, mid-season.

For long-term monitoring, pick a time of year that seems most appropriate to have a good look at the area or subject of interest and put the date on the calendar once a year for the next 10 years! Changes in the landscape happen slowly. It takes long-term thinking, perspective and commitment to being a good land steward.

CONSISTENCY

After making the decision to monitor, the single most important thing you can do to get *useful* results is to be *consistent*. That may mean doing something the same day and time on a certain day of the week if you

have chosen a weekly schedule. If your monitoring involves seasonal or annual information gathering, make a note ahead of time on a calendar so that you actually remember to get out there at the right time. It will probably be important to use the same equipment, too, and to follow the same routine. More about that later.

How To Monitor

Monitoring is really fairly easy. Following a few basic guidelines is what makes the difference in the value of the information. This discussion assumes that you plan to implement some changes on the land or in the way you manage it or live with it. That may not be the case at all. You may just want to “watch” a wild-land area for a period of time to see how it’s doing and compare it to other areas. That’s fine. The location selection process is still the same and so are the activities. Monitoring intangibles, such as quality of life and other things mentioned earlier, takes a slightly different twist, but the principles are the same.

PLANNING

The key to success here is to be clear on what your goals are!

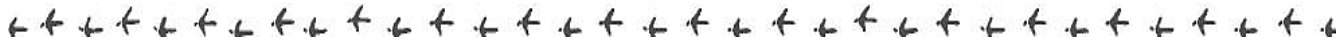
Take a walk out onto your property with a copy of the worksheet from the topic section you’d like to work on, and perhaps an extra note pad. Bring a blank copy of a Monitoring Planning Sheet (following page). Fill out the planning sheet as you stand there and look around. These are the questions to ask yourself:



- What do I like *most* about this place? (Start out *positive*!)
- What is my ideal for this place?
- What could bring it closer to my ideal?
- Pick out 2 or 3 specific spots that fall short (no more!).
- Choose 1 (at most 2) things to work on in those spots.
- Spend some time thinking and getting clear on your goals.

If you want to take on several sites, or several topics, repeat the above process, as desired.

With that admittedly broad and loosely defined set of boundaries for monitoring, you are ready to begin.



QUALITY OF LIFE AND FARM FAMILY FACTORS

Ask the following questions of each participant in your farm/family meeting (answers can be drawn as well as written). Consider making copies and allowing each participant to fill them out privately, then discuss them as a group. You could then make a combined worksheet or a diagram on a large piece of paper. Very young family members could have the questions read to them. They could answer by drawing an appropriate picture or someone could write down their answers.

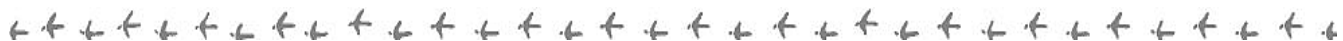
1. What is it that drew/draws me to farm life?
 - a.
 - b.
 - c.
2. What things have made me feel that I am experiencing what I had hoped for?
 - a.
 - b.
 - c.
3. What things do I enjoy most about my life in relation to the farm?
 - a.
 - b.
 - c.
4. What things do I like least about my life in relation to the farm?
 - a.
 - b.
 - c.
5. What could I do to get more of what I like from farm life?
 - a.
 - b.
 - c.
6. What things could I do to reduce the importance of or eliminate the things I like the least ?
 - a.
 - b.
 - c.
7. Where would I like the farm to be in 5 years? Ten years? When I retire and pass it along to my children?

5 years:

At retirement:

10 years:

At death:



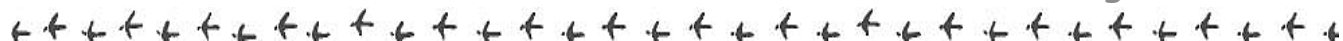


8. What role does my farm play in my community?
 - a.
 - b.
9. What role do I play in my community?
 - a.
 - b.
10. What two things would I change about my farm to have it play a different role in my community?
 - a.
 - b.
11. What would I like to change about my role in my community?
 - a.
 - b.
12. What things could I do to accomplish that change?
 - a.
 - b.
13. What values do I have that I want reflected in my farm?
 - a.
 - b.
14. Which of my values are reflected in my farm now?
 - a.
 - b.
15. Which of my values are not yet reflected in my farm?
 - a.
 - b.
16. What do I need to get where I want to go regarding my values?
 - a.
 - b.
17. What time frame do I want to work with?
 - a.
 - b.

Some additional questions might include the following:

- ☞ Who in the family can contribute to the farm?
- ☞ How much time can I spend with my family?
- ☞ How can I get and keep my children interested in keeping the farm?





MONITORING PLANNING SHEET

What do I like *most* about this place?

1. _____
2. _____
3. _____

What is my ideal for this place?

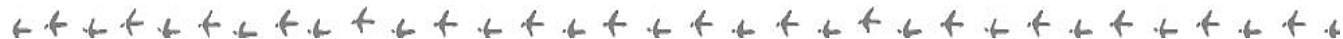
What could bring it closer to my ideal?

- Pick out 2 or 3 specific spots that fall short (no more!).
- Choose 1 (at most 2) things to work on in those spots.

- Location 1. _____
- a. _____
- b. _____

- Location 2. _____
- a. _____
- b. _____

- Location 3. _____
- a. _____
- b. _____





II. PHOTO MONITORING

Discussion

If you were only to do one kind of monitoring on your farm or ranch, it should be photo monitoring. It is the simplest and most striking kind of monitoring you can do for long-term change. It can also provide very dramatic evidence to friends, family, and community of the changes that are being accomplished.

Photo monitoring means taking pictures from exactly the same locations and looking exactly the same direction, over time. You could take pictures once each season, once each year, or once every 3 to 5 years. Photographs can give you a clear, visual image of progress or changes over time.

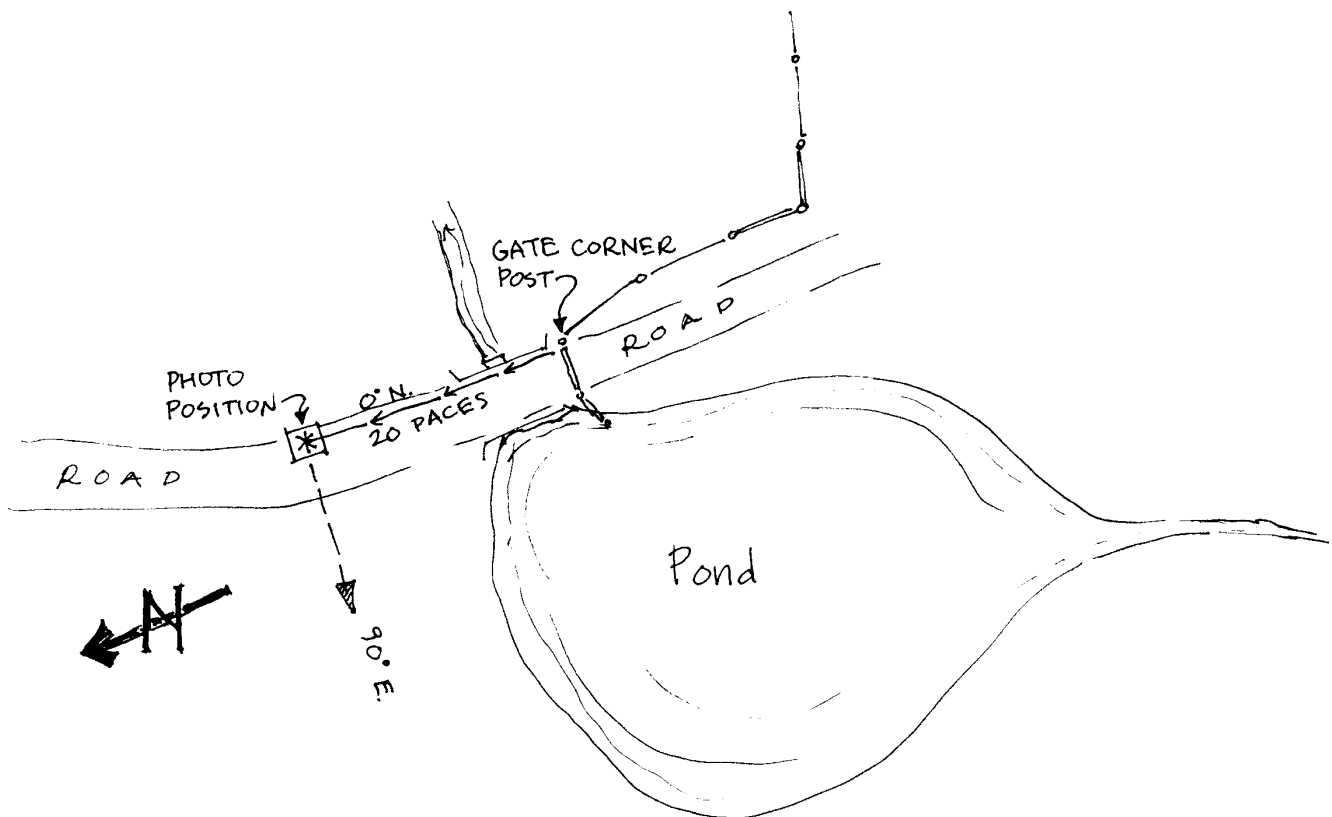
Photo monitoring can be done using a very relaxed approach while still accomplishing your purposes. This section will explain a slightly more formalized method. You can adjust it to fit your time constraints.

Equipment

- Camera – any type, but use the same type each time
- Film – any type, according to preference, but use the same type each time
- Steel fence posts, paint, or other markers (optional)
- Compass
- Notebook
- Pencil
- Photo album

Costs

Your costs could reach the thousands if you purchase a new digital camera. If you buy a disposable camera, an album, and you don't need the fence-posts your costs will be under \$20.00.



Procedure

The best way to start your photo monitoring sequence of pictures is to look up historic photographs. If you have inherited your property from a long-time ranching family, they may have photographs taken from a generation ago. If not, there may be historic records elsewhere in the county. These pictures can help you to clarify the historic vegetative cover levels, forest expansion or demise, changes in watercourses, or locate landmarks. The location and perspective of historic photos may help you decide the location for future photo monitoring sites.

Choose several areas where you would like to do photo monitoring, for example a fence-line, a creek bed, and a hill side that slopes down into a valley.

Along the fence line, select one of the posts as the point from which you will take your picture. Mark the post in some permanent way. A bright-colored spray paint may last for several years. Decide in which direction or directions you will be taking pictures. You

may want to pivot 180° to take a photo going the other direction along the fence, too. Take notes on your decisions so that when you come back you can get comparable pictures.

Go to the creek bed and decide what areas are most interesting to you and would lend themselves best to photographs. Place a fence-post as a marker, or triangulate off of a landmark. You could also use a large tree as a starting point, walk a certain number of paces from it in a specific direction (use the compass), pivot and take the picture facing the direction of your choice (use the compass). Be sure to take notes or make sketches.

Now go to your hill and valley area. Decide what view might give you the best opportunity to track the kind of changes you are interested in, such as vegetative cover, weed levels, erosion, gully formation, or tree growth. Place your steel post as a marker, but if this location happens to be a cattle grazing paddock, understand that they may use it as a scratching post and knock it over. In this case, it would be wise to also triangulate from an existing, permanent landmark. Use the compass to determine the direction of the photos you wish to take and write the information down.





Use the compass to get an exact directional reading for each of the photo directions so that you can come back the next time and use the compass to get exactly the same direction.

In any of the above locations, you may also want to do close-up photo monitoring. This might give you a sense of specific vegetation composition and changes in them over time. For this, construct a quadrat, as explained in the Plants section. Place the quadrat on the ground in an area you would like a close-up record of. Take the photos from a distance that will illustrate the area, but take notes on what you did.

In your notebook, record the type of camera and film you used, the lens type, and of course the date, time, location and any other helpful information you can think of about the photographs and the site.

When you get the pictures back after developing, record on the backs the same information you recorded in your notebook: date, time, location, camera, lens, film, photo direction and any other comments.

Place the first photos for each location on a separate page, perhaps with several pages in between each “first shot,” so that you will have separate sections for each photo point. Subsequent photos can be placed in chronological order following the first shots.

Time estimate

Setting up each photo point will take between 1/2 and 1 hour, not including the travel time in between locations. Subsequent visits to each site will require only the time it takes to snap a few pictures (adding in the time to admire the view).



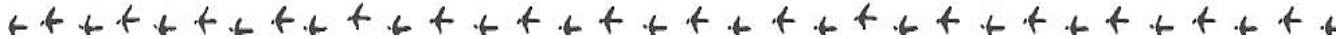


PHOTO MONITORING SUMMARY CARD

Date: _____ Time: _____ Location (field): _____

Sketch of field, photo point locations, compass angles, landmarks:

Equipment:

Camera – any type, but use the same type each time

Film – any type, according to preference, but use the same type each time

Steel fence posts, paint, or other markers (optional)

Compass

Notebook

Pencil

Photo album

Procedure Summary:

Choose the photo monitoring location.

Sketch the area, including compass angles, distance estimates and arrows for camera direction.

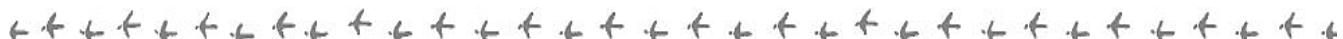
Take photos, including close-ups with quadrats, if desired.

Take notes.

Develop film.

Label photographs.

Place in album, with separate sections for each photo point location.





III. SOILS

This section will deal with some basic and functional characteristics of your farm soils that easily lend themselves to monitoring. These include:

- Infiltration (related to water-holding capacity)
- Soil nutrient status
- Earthworm population (related to soil health)

There will also be a brief discussion on assessing soil moisture and soil texture, with additional information sources listed under Resources at the end of this section.

Before starting, provide yourself with a good basic understanding of your own local soils. If you haven't already, look up your farm in the county soil survey, available from your local Field Office of the USDA Natural Resources Conservation Service (NRCS). Locate them in the US Government Section of your telephone book. Some soil survey information for Yolo County is now available on the World Wide Web at <http://www.ca.nrcs.usda.gov/mlra/yolo>. The soil survey will provide you with lots of information about the soil types you may have and their characteristics, and where soil types change in your fields. That can be invaluable in helping you decide where to sample.

Estimating Soil Moisture

Soil moisture content can change rapidly and is easy to manipulate through irrigation. It doesn't fall into the typical category of things to be monitored over the long-term, but can be very useful in making irrigation decisions. If you do not irrigate your land, it might be telling to check soil moisture several days after a rain to begin to learn about how your soils absorb and hold moisture. There are some simple field-techniques (as contrasted with laboratory techniques) that can be used to estimate it. Practice is the key to improved accuracy in your estimates.

If you are working with a uniform soil type, check a minimum of 4 sites per field, using a shovel to get your samples. Try to check at several depths, down through the rooting zone of your crop. The technique to use involves squeezing a handful of soil together in your palm to form an irregular ball that sticks together somewhat. Squeeze a ribbon of soil off of this ball by pushing the soil between your thumb and the side of your index finger. Next, make some observations about how it looks, including the ability to ribbon, the firmness and roughness of the ball, water on the surface of the ball, loose soil particles, staining on your fingers, and how quickly the ball breaks apart when bounced on your palm.

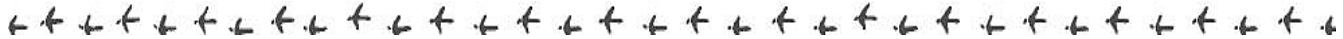
A silty loam soil at field capacity (holding all of the free moisture that it can, or 100% of available water) will look wet and show free water on the ball surface just after squeezing. It will form a soft ball, and leave a moderate to heavy coating of soil on your fingers and palm.

At 75 – 100% of available moisture, the ball will be wet and hold clear finger marks when squeezed. There will be a light to heavy coating of soil on your palm and fingers and it will ribbon.

At 50 – 75% of available moisture, a ball will form, appear moist, and leave a light coating of soil on your hand. A weak ribbon will form between the thumb and index finger.

	No ball	Ball, no ribbon	1 inch ribbon	1-2 inch ribbon	> 2 inch ribbon
Soil feels:					
gritty	sand				
gritty		loamy sand			
gritty			sandy loam	sandy clay loam	sandy clay
smooth			silty loam	silty clay loam	silty loam
gritty & smooth			loam	clay loam	clay



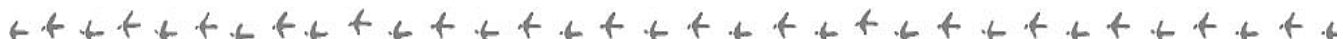


At 25 – 50% of available moisture, only a weak ball will form, and although it will appear slightly moist, it will have a rough surface and pieces will break away. There will not be any soil staining on your hand.

Soils with varying percentages of sand, silt and clay, will show variations of these characteristics at the different moisture content levels. For example, those with higher clay content will ribbon more easily. Please refer to the free USDA-NRCS brochure listed at the end of this section. It has excellent pictures for reference.

Assessing Soil Texture

Soil texture refers to the relative amounts of sand, silt and clay, as well as small rock pieces and organic matter. Use a form of the “ribbon” method, mentioned above, to estimate your soil texture. Using a handful of soil, spray or drip small amounts of water onto it and knead it in your hand until it forms a ball. Squeeze some soil out between your thumb and the edge of your forefinger so that it forms a ribbon that extends over your forefinger. Keep extending the ribbon until it breaks, and take note of how long a ribbon was formed, and whether it felt smooth or gritty.



INFILTRATION

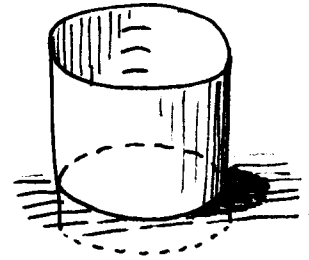
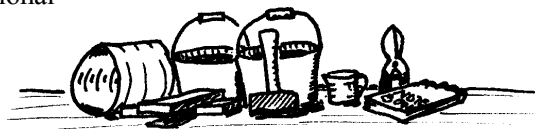
Discussion

If you are changing some cultural practices that might affect the organic matter content of your soil, compaction, or other things that you think may change the penetration of water, infiltration may be a useful parameter for you to monitor.

Water infiltration rates refer to how quickly water is absorbed into and drains through a soil. The rates are affected by soil type, saturation level, organic matter content, soil chemistry, weather conditions, compaction or hardpan, presence of existing (live) plants, plant species present, past and present land uses practices, and many other things. You may be able to control some of those factors; others, such as weather conditions, you have no control over. It is still possible to measure the existing status of water infiltration rates, while making notes on existing weather or soil conditions that might be extenuating. Attention to, and careful notes on existing conditions that may affect infiltration will allow measurements from year to year to be more comparable.

Equipment [infiltrometer]

- 6 inch aluminum irrigation pipe, cut in 8" lengths (mark 1 inch (or 1/2 inch also, if desired) increments on the inside of each 8" cylinder)
- several 1 ft. long (or longer) boards, to assist in pounding the rings into the soil
- 2 lb. Sledge or hammer
- gallon jugs or 5 gallon bucket to carry water
- measuring cup (approx. 4 cup capacity) with English and metric marks
- timer or watch
- notepad
- clippers, optional
- ruler, optional



6" ALUMINUM IRRIGATION PIPE
- 8" TALL
- MARK INSIDE IN 1" INCREMENTS

Alternative Equipment

If you are unable to get 6" aluminum irrigation pipes, then use a large coffee can. Re-calculate the volume of water needed to equal 2" of irrigation or rainfall.

$$V = \pi r^2 h$$

V = volume of water needed

π = 3.1416 (mathematical constant used with circles, cylinders, and spheres)

r = radius or 1/2 the distance across the widest part of the ring (1/2 x 6in. or 15.24 cm) or coffee can (1/2 x 6.25in. or 15.88cm)

h = the height you wish to reach; in this case 2 inches (5.08cm) of water to be applied inside of the infiltration ring

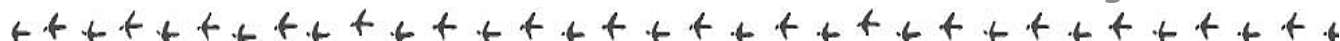
Examples

Irrigation Pipe

$$\begin{aligned} V &= \pi r^2 h \\ &= (3.1416)(7.62\text{cm})^2(5.08\text{cm}) \\ &= 926.67\text{cm}^3 \\ &= 926.67\text{ml} \end{aligned}$$

Coffee Can

$$\begin{aligned} V &= \pi r^2 h \\ &= (3.1416)(7.94\text{cm})^2(5.08\text{cm}) \\ &= 1006.13\text{cm}^3 \\ &= 1006.13\text{ml} \end{aligned}$$



Costs

The costs of this apparatus are negligible. All equipment should be generally available. Short irrigation pipe sections can be obtained from irrigation supply yard scrap-piles.

Procedures

Select a location that represents your soils well. If you have two soil types within one field then select infiltration monitoring locations in both soil types. Choose separate locations for each crop, cropping system or field.

Mark the locations well. You *must* be able to go back to the same spot (within a few feet) seasonally or yearly. Wire flags on field edges can be useful – if they won't get disced under. In orchards, colored surveyors flagging tied to a branch can help – as long as they won't get pruned off. Field edge "landmarks" such as telephone poles or large trees can be helpful to triangulate from. Then you could pace the distance to the monitoring site. Draw a sketch, noting the number of paces.

Fill your water bucket(s) with water from or near the site, or with the same water the crop might be irrigated with. Don't use tap or treated water from your office or home. The water chemistry will likely be different. This can change the interactions with the soil and could affect the infiltration rate.

After selecting the location for your infiltration study, clear the vegetation in the area where you will be placing it. Do not pull the plants out; that will disturb the soil surface and change the infiltration rate. Instead, try to nip them off with your fingernails or clip them off at the soil level with clippers.

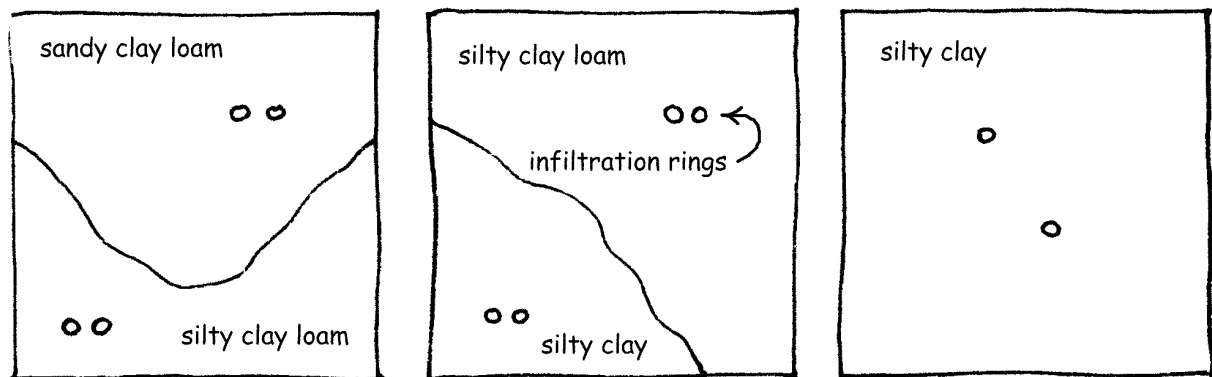
Place the ring on the ground and balance one of the boards across both edges of the ring. Hammer the ring in by hammering on the board. Hammering on the ring will only bend it.

The ring should be pounded 4 inches into the ground and kept level. Use the 1 inch marks on the inside to gauge how deep it is. Absolute minimum is 2 inches, although a depth that shallow can increase the risk of being affected by soil cracks. Some soils are so heavy that you may barely be able to get it in 3 inches. Whatever depth you choose, be *sure* to continue to use the same depth for all of your other locations and for each subsequent test dates.

Once you get the hang of it, you can probably manage two or more infiltration rings at a time, so you could set several up at once.

Once the ring is set, measure out the volume of water you need (i.e. 927ml or 1006ml). Pour the water in gently but not too slowly and begin timing. Some soil – if sandy or cracked – will absorb it all in a matter of seconds or a couple of minutes. Others will take many hours. You will probably have some idea ahead of

Infiltration Fields (oo = pair of infiltration rings)



40 ACRE ALMOND
ORCHARD

40 ACRES of ALFALFA

40 ACRES of TOMATOES



time. You may want to bring a book to read, or you could choose to come back and check it/them once an hour.

Record on the data sheet (in this section) the total time it takes for the 2 inches of water to penetrate. I consider it to be fully infiltrated when all of the small puddles of free water are gone and there is no more shine or reflection from the water.

If you want to do hourly checks on the water level, rather than sitting and watching it, then each hour, record the time and the inches of water that have infiltrated (Inches infiltrated equals the drop in water level from the moment you first poured the water in. If calculations are correct, the original level should be 2 inches above the soil level – as marked inside the ring. Try to get down to at least quarter-inch increments in your notations)

If you are checking a clay soil that tends to swell a lot when saturated, a ruler may work better to measure the amount of water *left*. Dip the ruler in the water until it barely touches the soil and record the number of inches (or cm). With heavy soils that swell a lot, the ruler method is best. Some soils may swell 1/2 inch or more upwards in the ring and affect your numbers. Subtract that number from the original 2 inches that you poured in, and you will have the amount of water infiltrated.

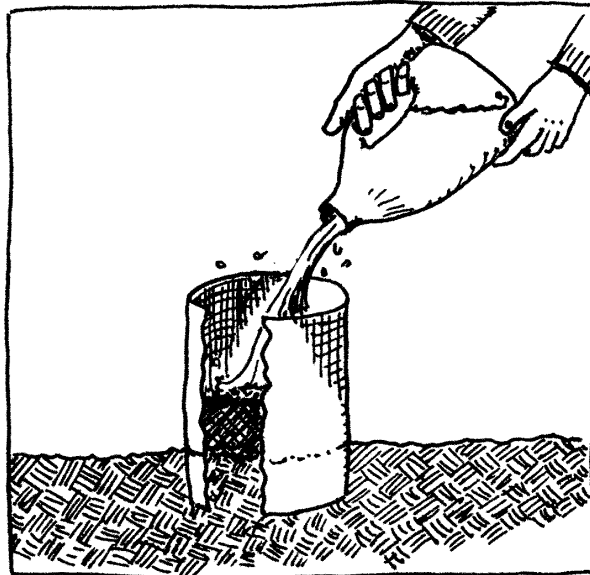
After the first 2 inches has infiltrated, repeat the process at least one or preferably two more times. You will find that infiltration usually slows after the first addition of water.

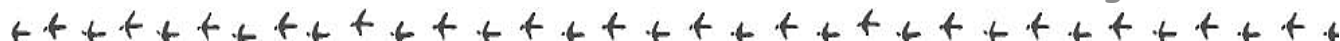
It is important to finish all of the infiltration sites for a field or block within a few days of each other. Changes in weather conditions, especially rain, can change infiltration.

Infiltration needn't be checked any more frequently than twice a year. Once may be sufficient, but always do it at the same time of year.

Time estimate

Time requirements vary greatly. With sandy soils, each 2 inches can infiltrate in a minute or less. With clay soils, the first 2 inches may infiltrate in 5 to 10 minutes, but the subsequent water may take many hours (overnight). If working with heavy soils, watch the first set of water closely. For subsequent sets, you may want to leave, and come back occasionally to check it.





INFILTRATION SUMMARY CARD

Date: _____ Time: _____ Location (field): _____

Sketch of field, sample site locations, and their labels:

Equipment:

6 inch aluminum irrigation pipe, cut in 8" lengths (mark 1 inch (or 1/2 inch also, if desired) increments on the inside of each 8" cylinder)

several 1 ft. long (or longer) boards, to assist in pounding the rings into the soil

2 lb. sledge or hammer

gallon jugs or 5 gallon bucket to carry water

measuring cup (approx. 4 cup capacity) with English and metric marks

timer or watch

notepad

clippers, optional

ruler, optional

Procedure Summary:

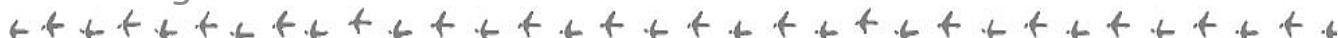
Clear vegetation, but do not pull or otherwise disturb the soil surface.

Pound ring 3 – 4 inches into soil.

Pour in 2 inches of water (927 ml if using standard 6 inch irrigation pipe).

Record time for water to completely infiltrate, or record inches of water infiltrated over specified time period.





INFILTRATION DATA SHEET

(site location)	Start time	End time	Time elapsed	Infiltration rate (total inches water ÷ total min. or hrs.)
1 st 2 inches water				
2 nd 2 inches water				
3 rd 2 inches water				

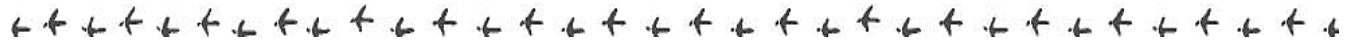
(site location)	Start time	End time	Time elapsed	Infiltration rate (total inches water ÷ total min. or hrs.)
1 st 2 inches water				
2 nd 2 inches water				
3 rd 2 inches water				

(site location)	Start time	End time	Time elapsed	Infiltration rate (total inches water ÷ total min. or hrs.)
1 st 2 inches water				
2 nd 2 inches water				
3 rd 2 inches water				

(site location)	Start time	End time	Time elapsed	Infiltration rate (total inches water ÷ total min. or hrs.)
1 st 2 inches water				
2 nd 2 inches water				
3 rd 2 inches water				

(site location)	Start time	End time	Time elapsed	Infiltration rate (total inches water ÷ total min. or hrs.)
1 st 2 inches water				
2 nd 2 inches water				
3 rd 2 inches water				





INFILTRATION PLANNING QUESTIONS

What soil condition or situation leads me to want to monitor the infiltration rate?

- 1.
- 2.
- 3.

Where can I realistically do monitoring of each of these conditions?

- 1.
- 2.
- 3.

What question can I ask myself that will clearly define my concerns about soil conditions 1., 2., and 3.?

- 1.
- 2.
- 3.

What activity or activities can I do to answer question 1., 2., and 3. above?

- 1.
- 2.
- 3.

How often should I do each of the activities (daily, weekly, monthly, seasonally, yearly)?

- 1.
- 2.
- 3.

